PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B68G 9/00

A1

(11) International Publication Number: WO 99/32396

(43) International Publication Date: 1 July 1999 (01.07.99)

(21) International Application Number: PCT/CA98/01188

(22) International Filing Date: 22 December 1998 (22.12.98)

(30) Priority Data:
08/995,857 22 December 1997 (22.12.97) US

(63) Related by Continuation (CON) or Continuation-in-Part (CIP) to Earlier Application
US 08/995,857 (CIP)
Filed on 22 December 1997 (22.12.97)

(71) Applicant *(for all designated States except US)*: SPRINGQUILT INDUSTRIES LTD. [CA/CA]; 910 Brock Road South, Pickering, Ontario L1W 1Z9 (CA).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: ZYSMAN, Milton [CA/CA]; Suite 801, 50 Prince Arthur Avenue, Toronto, Ontario M5R 1B5 (CA).

(74) Agent: PARSONS, Richard, A., R.; Ridout & Maybee, Suite 2400, One Queen Street East, Toronto, Ontario M5C 3B1 (CA).

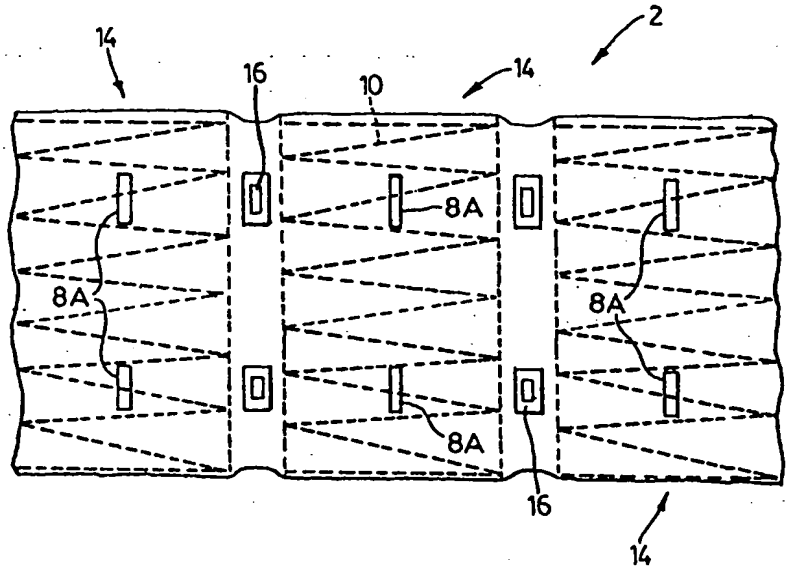
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: MANUFACTURE OF POCKET SPRING ASSEMBLIES

(57) Abstract

In the production of a pocket spring assembly, fabric is secured along multiple parallel seam zones so as to form a quilt defining a plurality of parallel fabric tubes connected to each other at uniformly space intervals. The tubes so formed are supported on guides extending longitudinally through the tubes, portions of the quilt are repeatedly drawn from the guides at their one ends and folds formed in each layer of fabric in the drawn off portions of the quilt, and precompressed coil springs are released into the pockets between each drawing of the quilt, with their axes perpendicular to both the axes of the fabric tubes and the direction of advancement of the quilt, so that secured folds in the fabric of the tubes in front of and behind the released springs retain them in the pockets. The quilt is formed in situ on the guides, preferably using a separate web of fabric for each tube. The connections (8A) between the tubes preferably have a span perpendicular to the plane of the quilt which is similar to the span of the connections (16) of the folds. The connections between the tubes and the connections of the folds are preferably thermal welds.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

MANUFACTURE OF POCKET SPRING ASSEMBLIES

This invention relates to pocket spring assemblies for mattresses and cushions, and to methods and apparatus for manufacturing such assemblies.

More specifically, it relates to improvements and developments of the invention described in WO94/18116. In the production of a pocket spring assembly as described in that application, fabric is secured along multiple parallel seam zones so as to form a quilt defining a plurality of parallel fabric tubes connected to each other at uniformly spaced intervals. The tubes so formed are supported on guides extending longitudinally through the tubes, portions of the quilt are repeatedly drawn from the guides at their one ends, folds formed in each layer of fabric in the drawn off portion are secured to form pockets from the drawn off portions of the quilt, and precompressed coil springs are passed through the guides and released into the pockets between each drawing of the quilt, with their axes perpendicular to both the axes of the fabric tubes and the direction of advancement of the quilt, so that secured folds in the fabric of the tubes in front of and behind the released springs retain them in the pockets.

It has now been found that considerable advantages may be obtained, not least continuity of production, by forming the quilt in situ on the guides. This is facilitated by forming the superposed layers of fabric in the quilt from adjacent portions of parallel webs of material, each of which is wrapped to form a parallel tube of the quilt, the tubes being connected side by side at spaced intervals to form the seam zones.

According to the invention, there is provided a method of producing a pocket spring assembly, comprising the steps of securing together webs of fabric along multiple parallel seam zones so as to form a quilt defining a plurality of parallel

fabric tubes extending longitudinally of a plane of the quilt, adjacent tubes so formed having regularly spaced connections between them at spaced intervals longitudinally of the tubes, supporting the formed tubes on guides extending longitudinally through the tubes, repeatedly drawing portions of the tubes formed by the quilt from the guides at their one end, pinching layers of fabric in upper and lower portions of the tubes in the drawn off portion to form folds extending oppositely out of the plane of the quilt at locations intermediate the connections between the tubes, securing the folds by connections to form pockets in the drawn off portions of the quilt, and passing precompressed coil springs through the guides and releasing them into the pockets between each drawing of the quilt, with their axes perpendicular to both the plane of the quilt and the direction of advancement of the quilt, so that the secured folds in the fabric of the tubes in front of and behind the released springs retain them in a two dimensional array of pockets with the axes of the springs perpendicular to the plane of the quilt, wherein the quilt is formed in situ on the guides by forming thereon the tubes and the regularly spaced connections between them. Preferably each tube is formed by wrapping a separate web of fabric around each guide, and the connections between the tubes are formed by securing the tubes so formed to one another between the guides. Preferably the connections are formed by thermal welding fusible material comprised by the fabric. Preferably also each connection between the tubes has a span perpendicular to the plane of the quilt similar to the spacing between the connections of the oppositely directed folds, and the connections between the folds are formed by welds.

The invention also extends to apparatus for performing the above method, and to pocket spring assemblies manufactured thereby.

Further features of the invention will be apparent from the following description of embodiments of the invention with reference to the accompanying drawings.

IN THE DRAWINGS:

Figures 1A, 1B and 1C illustrate modifications to the apparatus and method of WO94/18116;

Figure 2 is a vertical section through a spring assembly produced by the modified apparatus of Figure 1, on a line extending parallel to and between adjacent tubes;

Figure 3 is a general arrangement plan of a revised and presently preferred embodiment of the apparatus of the invention, in which the assembly apparatus proper is shown to the right of the Figure;

Figure 4 is a perspective view of part of a spring feed zone of the assembly apparatus;

Figure 4A, 4C and 4E are fragmentary vertical sectional views, and Figures 4B, 4D and 4F are fragmentary broken away plan views illustrating further stages in the transfer of a spring from the conveyor into a spring assembly;

Figure 5 is a perspective view of part of a tube forming and cross-welding zone of the assembly apparatus;

Figure 6A and 6B are simplified fragmentary lateral vertical sections illustrating operation of fabric feeding elements shown in Figure 5;

Figures 7A and 7B are lateral vertical sections through tube forming assemblies shown in Figure 5;

Figure 8 is a section through a single tube forming assembly on the line 8-8 in Figure 9;

Figure 9 is a section of the line 9-9 in Figure 8;

Figure 10 is a perspective view from a front and above of a single tube forming assembly;

Figure 11 is a perspective view of part of a pulling and spring pocketing zone of the assembly apparatus;

Figure 12 is a side view of pulling elements shown in Figure 11, illustrating a pulling cycle;

Figures 13A and 13B are side views of pocket welding elements shown in Figure 11;

Figures 14A and 14B are fragmentary frontal views illustrating the operation of the pocket welding elements;

Figure 15 is a simplified fragmentary cut-away plan view of the pulling and spring pocketing zone showing elements used to sever a completed spring assembly.

While the method of providing a spring assembly described in WO94/18116 utilizes a preformed quilt, Figures 1A, 1B and 1C illustrate how the apparatus described in that published application can be modified to enable the quilt to be formed in situ on tubes 72 of assemblies 70. In one possible arrangement, the two layers of fabric for forming the upper and lower layers of the fabric tubes are drawn from rolls above and below the array of assemblies 70, and are secured together between the assemblies by heat sealing and cutting tools acting from above and below between adjacent tubes 72. The substantial lateral gathering of the fabric that will occur in forming the tubes entails the provision of apparatus to fold or pleat the fabric from the rolls to provide for the gathering. Additionally, means must be provided between the tubes to weld or otherwise seam together the fabric layers and to slit the seams so formed. This is difficult in the limited space available.

In view of the large degree of gathering of the fabric involved in forming it into adjacent tubes surrounding the

assemblies 70, and the desirability of providing vertical extent to the connections between the tubes as discussed below, it is presently preferred for in situ forming of the quilt to use a separate web of material to form each tube. This permits means for securing the tubes together to be located within rather than between the assemblies 70.

It has been found that spring assemblies produced as described in WO94/18116 can permit such a high degree of independent motion of the springs that sufficient relative displacement of springs in adjacent rows can result in interference between coils of adjacent springs, causing undesirable noise as a user moves on a mattress or cushion incorporating the assembly. It has now been found that this problem can be overcome by arranging that the connections between adjacent columns of springs formed in adjacent tubes of the quilt have a significant vertical extent, for example by providing fastenings 8A (see Figure 2) between adjacent tubes above and below a central horizontal plane of the spring assembly, so that the span of the connections between adjacent tubes in a direction perpendicular to the quilt is similar to the span in the same direction of fastenings 16, formed between successive springs in a tube. The modified assembly 70, shown in Figures 1A, 1B and 1C, permits both in situ formation of the quilt, and the formation of connections 8A having significant vertical extent. Most of the differences from the apparatus of WO94/18116 involve added parts, namely members 100 forming a tubular sleeve surrounding each spring insertion mechanism 70 except for the slots 71 and providing a sleeve for supporting the quilt 24 which is formed in situ from plural webs of material 102 drawn from spools (not shown). The webs are conveniently folded double on the spool and the spools are so oriented with their axes parallel to the tubes that each web moves upwardly towards the shell 100 and presents a fold 104 towards the rear of the machine. Forward edges 106 of the fabric 102 pass into diagonal slots 108 in a folding guide 110 which like the sleeve 100 is supported from a fixed member 112. Pulling the quilt 24 forwardly over the sleeve

results in the slots in the folding guide folding the fabric 102 around the sleeve so that the edges 106 overlap to form a tube. Within the sleeve 100, actuators 114 and 116, typically pneumatically operated, are provided carrying movable jaws 124, 126 and 128. The jaw 124 cooperates with a fixed jaw formed by an anvil 134 on the guide 110 to form longitudinal welds on the lapped edges 106 of the fabric web and thus seam it into a tube. The jaws 126 and 128 cooperate with corresponding jaws in an adjacent sleeve 100 so as to weld the fabric of adjacent tubes together at vertically spaced connections 8A, the spacing of which is similar to that of the connections formed in the folds of the upper and lower layers of fabric of each tube to separate rows of springs in the tubes. In this embodiment, it is preferred that the fastener guns shown in WO94/18116 be replaced by welding mechanisms with actuators and jaws similar to those described above. Rather than providing one or more travelling mechanisms to fasten the folds, pairs of welding jaws and actuators may instead be associated with each assembly 70, mounted above and below the outer ends of the tubes 72. This enables a long welding cycle to be provided between each draw of the quilt 24 for all of the welding mechanisms used, in each of which the jaws may be closed against each other through the two layers of fabric to be welded, a heating element associated with at least one of the jaws being activated to fuse the fabric material. The jaws may then remain closed with the heating element deactivated while the weld sets. The time available for this cycle is that required to insert a complete row of springs so that there is ample time to set the welds before they are subjected to stress.

It will be noted that with this modification there will be connections formed by the welds 8A between each pocket and an adjacent pocket, each connection having an approximately equal span. Between pockets lengthwise of the tube, the welds or other connections 16 securing the folds will provide a connection having a substantial span extending above and below a centre plane of the quilt, and the connections 8A

between the tubes of the quilt formed in situ on the assemblies 70 will have a similar span. The span of these connections, which is of course considerably less than the height of a spring expanded within a pocket, and even less than the free height of a spring, is sufficient to provide adequate connection between adjacent pockets to maintain spring orientation in the pockets sufficiently to prevent inter-spring interference, without prejudicing the independent compressibility of the springs which is a feature of pocket spring mattresses.

Since the length of the assembly that can be produced when the quilt is formed in situ is limited only by the length of fabric on the rolls from which the webs 102 are fed, it will usually be desirable to provide for cutting the quilt when an assembly of sufficient length has been formed. This may be achieved by running a pass of the apparatus with the spring feed disabled so as to produce a row of empty pockets through which the cut may be made.

Figure 3 onwards illustrate a modified and presently preferred embodiment of the invention, incorporating many of the same principles as described with reference to Figures 1A, 1B, 1C and 2, but redesigned to take full advantage of the ability to form the quilt in situ, and to avoid the necessity for the moving laterally of the table, trolley and spring making machine described in WO94/18116.

A general layout of the apparatus is shown in Figure 3. The apparatus for forming the spring assemblies is shown schematically at 200, alongside a table 202 for receiving each assembly as it is formed. Springs are fed to the apparatus 200 by an upper view of a conveyor 204 which receives them from spring making and tempering machines 206, the construction of which and of associated wire feeds 208 and control units 210 forms no part of the invention and will not be described further. Springs on the conveyor which were heat treated in the spring making machine pass an optional cooling fan 214 before reaching the apparatus 200. Webs of

material for forming tubes of a quilt in the apparatus 200 are drawn from rolls 216 and folded in two and turned through 90^0 by a folding assembly 218 before being passed as multiple folded superposed webs 220 (see Figure 5) to the apparatus 200, in a direction parallel to that of the conveyor 204, as best seen in Figure 5. The apparatus 200 is shown divided generally into functional zones, namely a spring feed zone 300, a tube forming and cross-welding zone 400, and a puller spring pocketing zone 500.

Referring now to Figure 4, an upper run of the spring conveyor 204 is seen extending laterally of the assembly apparatus between the spring feed zone 300 and a transverse cross member 402 supporting on its other side elements (not shown in this figure) of the tube-forming and cross welding zone 400. Individual coil springs 302 have bottom turns received in shoes 304 attached to the conveyor, springs being loaded and removed from the conveyor by moving their bottom turns perpendicular to the direction of movement of the conveyor. The conveyor moves a row of springs into the springs feed zone 300, alongside a row of vertical semi-cylindrical spring receivers 306. Only one end of this row is shown in Figure 3, but in practice the number of receivers will be equal to the maximum number of columns of springs required in a spring assembly to be formed. For mattress spring assemblies this number is typically at least 32 and preferably 40, depending on the spring size to be used, and assuming that the columns run transversely of the length of the mattress. It should be appreciated that many elements of the apparatus to be described will be duplicated identically for each column of springs in the assembly, and in all such cases only a single element or a few elements will be illustrated.

Opposite the receivers 306 is a transverse member 310 supporting a corresponding row of semi cylindrical spring pushers 308, which move with the member 310 during a row cycle of the apparatus in a path illustrated in broken lines. By "row cycle" is meant a cycle of operations of the

apparatus producing a row of springs in the assembly, i.e. one spring in each column. An initial arcuate forward movement of the pushers 308 by actuator 320 moves a row of springs 302 out of the shoes 304 into the receivers 306, the pushers cooperating with the receivers to form vertical tubes as seen in Figure 4A. The springs in the tubes are then compressed by plungers 312 to the condition shown in Figure 4A by downward movement of an actuating bar 314 driven by a actuator 316. Subsequently the member 310 and pushers 308 are lifted by actuator 318 so as to clear further springs that have been advanced by the conveyor, and moved rearwardly and downwardly to their original position by actuator 320 and actuator 318.

Referring now also to Figures 4A-4F, the springs 302 compressed by the plungers 312 are in line with open ends of horizontal forward extending transfer tubes 404, the rear ends of which pass through and are secured in the cross member 402. Also in line with the tubes 404 are push rods 322 passing through a transverse guide member 324 and connected to a transverse push bar 326 driven by atuators 328. The push rods 322 are tubular and contain secondary push rods 330 actuated by an actuator (not shown) operating between a secondary push bar (not shown) connected to the rods 322 and the push bar 326. At the forward ends of the push rods 326 are upper and lower plates forming duckbills 332 adapted to receive the springs 302 as the push rods are moved forward beneath the plungers 312, as seen in Figures 4C and 4D. When the duckbills 332 reach the limit of their travel at forward ends of the tubes 404 as seen in Figure 4E and 4F, the secondary push rods 330 are extended to eject the springs 302 from the duckbills, as discussed further below.

Figure 5 is a fragmentary view of the tube forming and cross-welding zone 400 of the apparatus in which zone the quilt is formed into which the springs are assembled. Tube forming assemblies 406 of which only a few are shown, are mounted on the cross-member 402 concentric with the spring transfer tubes 404, and receive folded webs 220 of fabric from a

pulling mechanisms comprising brake mechanisms 408 and 410 above a roller box 412 which turns the webs so that they rise beneath the assemblies 406, one web for each assembly.

The operation of the brake mechanisms 408 and 410 of the fabric puller assembly is best seen in Figures 6A and 6B. The purpose of the assembly is to draw measured lengths of fabric from the rolls 216, equal to the lengths of fabric drawn forward over the forming assemblies by a pulling assembly in zone 500, as described later. Each mechanism 408 and 410 is provided with a top plate 414 having slots to pass the folded fabric webs and a slotted brake plate 416, movable laterally to clamp the webs between the slots of the two plates by an actuator 418. The fabric is normally clamped by the actuator 418 of the top mechanism 408, but during a pulling operation, the actuator of the top mechanism is released and that of the mechanism 410 is engaged. A motor 422 drives lead screws 421 through belts 423 so as to raise the mechanism 10 and pull the fabric. After completion of the pulling stroke, the brake of the mechanism 410 is disengaged and that of the mechanism 408 is engaged so that the motor 422 may return the mechanism 410 to its original position ready for another pulling operation.

Above the mechanism 408, the webs 220, with the opening of their folds facing towards the front, pass upwardly around the assemblies 406 and are tuck-folded through 90° around the assembly so as to be directed forwardly with the fold openings directed upwardly. Each assembly 406 comprises a lower guide plate 424, which splits the fold of the fabric, and beneath which is mounted a guide rod assembly 426 whose rods guide the fabric over the outer portions of the plate 424. Folding guides 428 guide the free edges of the fabric onto an upper folding plate 430 with the free edges projecting upwardly, while the rear portion of the fabric is tuck folded forward over the plate 434 and passes between the plates 424 and 434. The guides 428 are supported from the cross member 402, as are the folding plates 430 and 434, the guide plates 424 and the tube 404. As best seen in Figure

10, the tube 404 supports anvil plates 436. Further details are visible from Figures 8 through 10.

In order to counter any tendency of the fabric to track incorrectly through the folding assemblies, an optical sensor 470 is located on each side of a fin projecting upwardly from the folding guide 530 between the edges of the fabric just forward of the guides 428. If the fabric moves out of alignment, one of its edges will move down and uncover the fin so that the misalignment will be detected by the sensor on that side. In response, the sensor will activate an actuator 472 on that side to press a skewed guide wheel 474 against the fabric, the wheel being angled to pinch the fabric against the guide 430 and steer it back on course until the fin is again covered, at which point the actuator is released.

Four actuating bars 440, 442, 444 and 446, operated by actuators 452 and 456, extend laterally of the row of assemblies 406, each being movable by its actuator through a short lateral stroke. The bars 440 and 442, as best seen in Figures 7A and 7B, actuate scissor arms 448 pivoted on a fixed lateral bar 438 so as to clamp free edges of the fabric between thermal welding elements 460 and anvils 462. The bars 444 and 446 operate rocker levers 458, pivoted to the tubes 404 to move welding elements 466 against the anvil plates 436. It will be noted that in Figures 7A,and 7B that the outermost rocker arms in the furthest left and further right assembly 406 in the row are omitted since they have no function to perform. Structures 454 and/or 468 supporting the actuating bars and associated parts may be mounted for limited forward and rear movement together with the parts they support, as described further below.

Figure 11 is a view of one end of the pulling and spring pocketing zone 500. It comprises a chassis 502 which is normally located just in front of the zone 400, but can be moved forwards on slide bars 504 by to permit access to zone 400, It comprises a spring pocketing assembly 508 and a quilt

puller assembly 510, at least the latter being movable forward and rearward by lead screws 506.

Referring to Figure 12, the quilt puller assembly comprises actuators 512 which raise and lower a cross member 514 carrying puller elements 516 which are moved upwardly by the actuators into slots occurring between successive welds 8A formed by welding elements 460, in order to pull a formed mattress assembly forward onto the table 202 (see Figure 3) and at the same time pull forward the quilt 464 formed on the assemblies 406 and pull up the folded fabric 220 fed by the assembly 410 (see Figure 6). The elements 516 are retracted downwardly during a return, rearward movement of the puller assembly.

The quilt puller assembly 410 may also be connected to the structures 454 and/or 468 so that, during a pulling operation, the welding elements 460 and/or 466 may be maintained clamped against their associated anvils and travel with the quilt formed on the forming assemblies 406. This provides a more even pulling action and further relieves any stress on the welds. If the welding elements 468 are movable, the anvil plates 438 and levers 458 should be supported on structure connected to the structure 468 rather than directly connected to the tubes 404. In like manner, the spring pocketing assembly 408 may be connected to move with the puller assembly 408 so as further to distribute the pulling forces and avoid stress on welds formed by the pocketing assembly as described below. Indeed, by pulling with the welding elements clamped against the anvils, it may be possible to disperse with the use of separate puller elements 516. It will be understood that in arrangements in which the welding elements and anvils travel during the pulling stroke, the elements and anvils are not released after a welding operation until after the pulling stroke is completed, whereas if they do not travel, they must be released prior ot the pulling stroke.

The spring pocketing assembly 508 (see Figures 13A, 13B, 14A, 14B and 15) which may be monitored on the chassis 502, ir travel with the pulling assembly 510. comprises actuators 520 which raise and lower a cross member 522 carrying laterally extending actuator bars 524 and 526 carrying respectively downwardly extending fingers 528 and 530. The fingers 528 carry welding elements 532 and the fingers 530 carry anvils 534 as best seen in Figures 14A and 14B. The bars 524 and 526 are actuated by actuators 536 and 538 for movement of the elements and anvils between the positions shown in Figure 14A, where they extend downwardly through slots between successive welds 8A between tubes in the quilt formed on the assemblies 406, and the position in Figure 14B, where they clamp the tubes and form the welds 16, either as vertically spaced welds as shown in Figure 2, or as single continuous welds extending through an horizontal centre plane of the quilt. The actuators 520 raise the assembly clear of the quilt during return motion of the carriage 502 (see Figure 13). The welds 16 pocket successive springs discharged from the tubes 404 as best seen in Figures 13A and 13B. As seen in Figure 15, the cross member 522 also caries a cutting wire 540, which can be activated when an assembly of sufficient length (sufficient rows of springs) has been formed and transferred to table 202, so as to sever the assembly. The severance will typically be made after a cycle in which no springs were delivered from the conveyor, so as to produce an empty length of quilt through which the cut may be made.

In use, the various actuators, lead screw motors and other movable parts are operated by a control program so to put the apparatus through successive cycles in which springs for a complete row of springs, one for each column of the completed assembly, are delivered by the conveyor 204 to the apparatus, and moved from the conveyor through the tubes 404 within the assemblies 406 as a length of quilt formed in situ on the assemblies 406 is drawn forward by the puller carriage 502 and welded as described with reference to Figures 13A, 13B, 14A and 14B to form pockets into which the springs are discharged. The various welding elements are preferably

electrically heated wires , since these are cheap and compact, and if the welds are formed well before pulling of the quilt occurs, there is ample time available for the welds to set before they are subjected to any stress. If the welding elements and anvils remain clamped during the pulling stroke, the welds have still further opportunity to set before being exposed to stress. The welds 8A and 16 are sufficiently vertically spaced that their upper and lower extremities are well above and below a centre line of the mattress assembly and of the quilt from which it is formed. This provides symmetrical support for the springs and inhibits possible interference between the springs due to inadequate lateral support. In order to provide the most effective welding, without undue weakening of the fabric, it is preferred to utilize a composite non-woven fabric formed of fibres of two different synthetic plastic resins, which will bond together, but one of which fuses at a considerably higher temperature than the other. Alternatively, the fibres themselves may be composite, with a lower fusing outer layer which bonds the fibres and a higher fusing core. The welding elements are energized so as to fuse only the lower melting component or layer.

CLAIMS:

1. A method of producing a pocket spring assembly, comprising the steps of securing together webs of fabric along multiple parallel seam zones so as to form a quilt defining a plurality of parallel fabric tubes extending longitudinally of a plane of the quilt, adjacent tubes so formed having regularly spaced connections between them at spaced intervals longitudinally of the tubes, supporting the formed tubes on guides extending longitudinally through the tubes, repeatedly drawing portions of the tubes formed by the quilt from the guides at their one end, pinching layers of fabric in upper and lower portions of the tubes in the drawn off portion to form folds extending oppositely out of the plane of the quilt at locations intermediate the connections between the tubes, securing the folds by connections to form pockets in the drawn off potions of the quilt, and passing precompressed coil springs through the guides and releasing them into the pockets between each drawing of the quilt, with their axes perpendicular to both the plane of the quilt and the direction of advancement of the quilt, so that the secured folds in the fabric of the tubes in front o and behind the released springs retain them in a two dimensional array of pockets with the axes of the springs perpendicular to the plane of the quilt, characterized in that the quilt is formed in situ on the guides by forming thereon the tubes and the regularly spaced connections between them.

2. A method according to claim 1, wherein each tube is formed by wrapping a separate web of fabric around each guide, and the connections between the tubes are formed by securing the tubes so formed to one another between the guides.

3. A method according to claim 1 or 2, wherein the connections are formed by thermal welding of fusible material comprised by the fabric.

4. A method according to any one of claims 1-3 wherein each connection between the tubes has a span perpendicular to the plane of the quilt which is similar to the span of a connection or connections between the oppositely directed folds.

5. A method according to claim 4, wherein the connections between the tubes are formed by a pair of welds spaced to either side of the plane of the quilt.

6. A method according to any one of claims 1-5, wherein the connections between the folds are formed by welds.

7. Apparatus for producing a pocket spring assembly, comprising a row of parallel guides for receiving therearound tubes defined in a quilt formed by connecting webs of fabric along zones parallel to longitudinal axes of the guides with adjacent tubes so formed having longitudinally regularly spaced connections between them, mechanism to withdraw successive portions of the quilt from ends of the guides, mechanism to form successive connections securing folds formed in the fabric of the drawn off portions at regularly spaced locations longitudinally intermediate the connections between the tubes to form pockets and mechanism to dispense compressed coil springs through longitudinal passage in the guides into the pockets as they are formed, with the axes of the springs perpendicular a common plane containing the longitudinal axes of the guides, characterized in that each guide is associated with folding elements to fold a web of fabric into a tube surrounding that guide as successive portions of the quilt are drawn from the guides, and fastening mechanisms to secure the tube so formed to establish longitudinally regularly spaced connections between the tube and tubes formed on adjacent guides.

8. Apparatus according to claim 6, wherein the fastening mechanisms establish connections having a span perpendicular to said common plane similar to a spacing perpendicular to said common plane of the connections of the folds.

9. Apparatus according to any one of claims 6, 7 and 8, wherein the mechanism so secure the folds comprises fabric welding devices establishing welds between successive springs.

10. A pocket spring assembly comprising a quilt formed from webs of fabric secured together along multiple parallel seam zones to form a plurality of fabric tubes with adjacent tubes so formed having regularly spaced connections between them longitudinally of the tubes, two layers of fabric forming each tube each being secured into a row of spaced folds by a plurality of connections r3egularly spaced in pairs along each fabric tube to form the fabric tubes into an array of pockets extending both longitudinally and laterally of the seam zones, and a coil spring extended within each pocket between connections to adjacent tubes with its axis perpendicular to a plane of the quilt, the connections in each pair securing the folds being located in opposite perpendicularly spaced directions out of the plane of the quilt and longitudinally intermediate the connections between the tubes, characterized in that each fabric tube is formed by a separate web of fabric, and the tubes are connected together at spaced intervals to form said spaced connections.

11. A pocket spring assembly according to claim 14, wherein the connections between the tubes have a span in opposite perpendicular directions out of the plane of the quilt similar to a span in said opposite perpendicular directions of the connections of the folds.

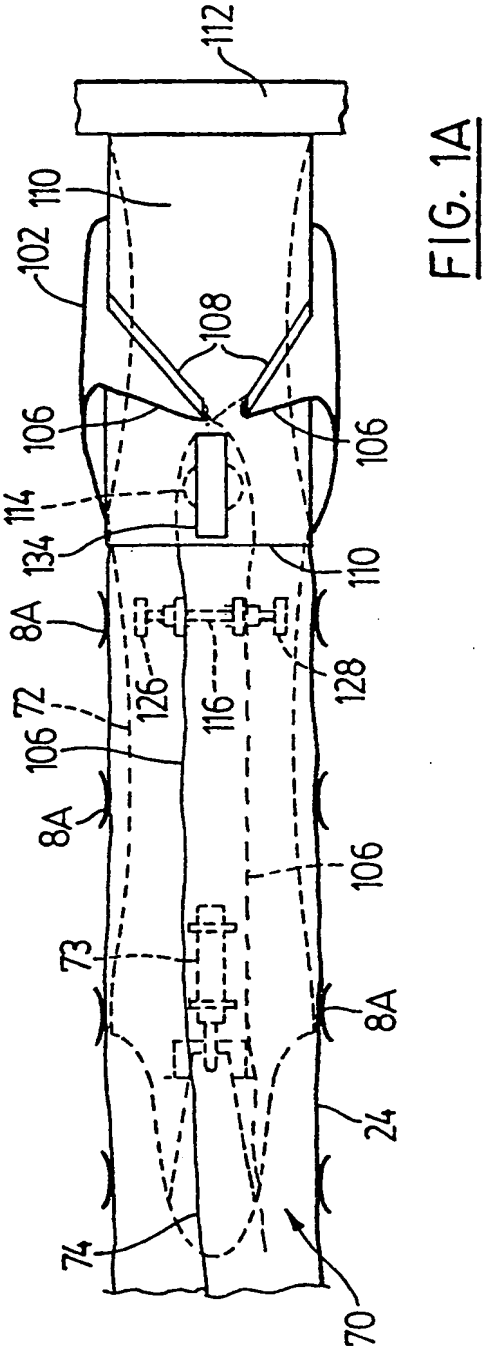


FIG. 1A

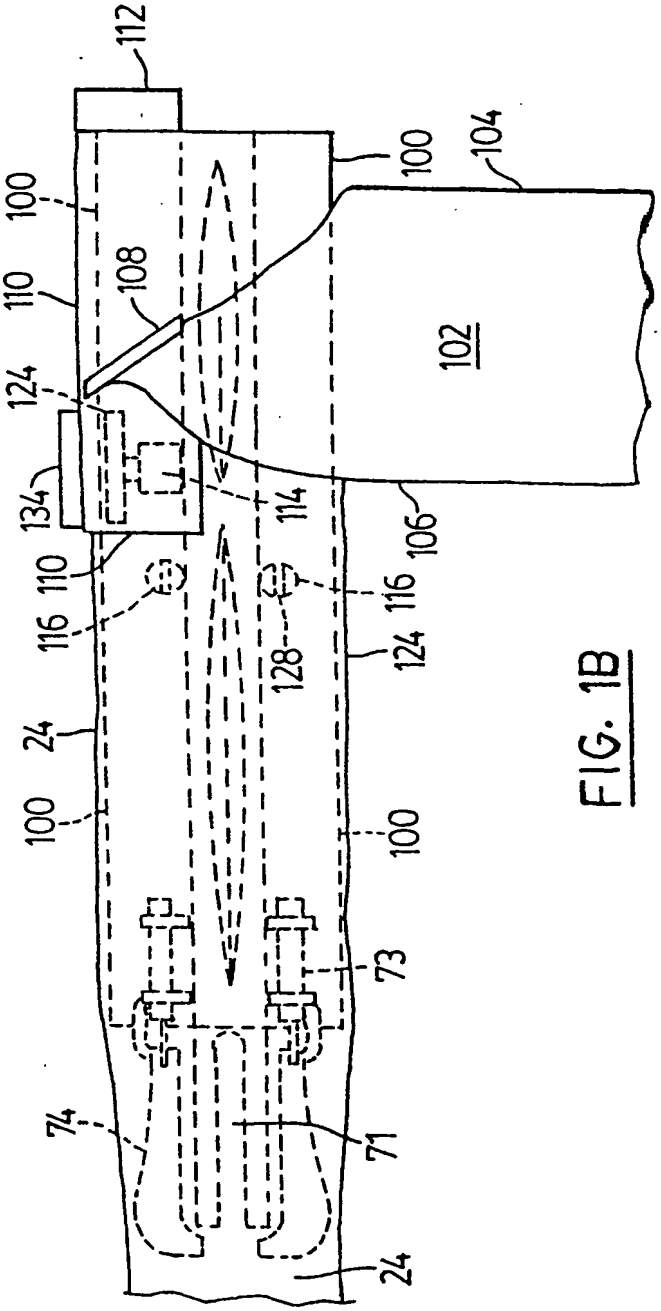


FIG. 1B

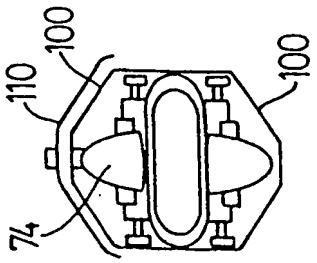


FIG. 1C

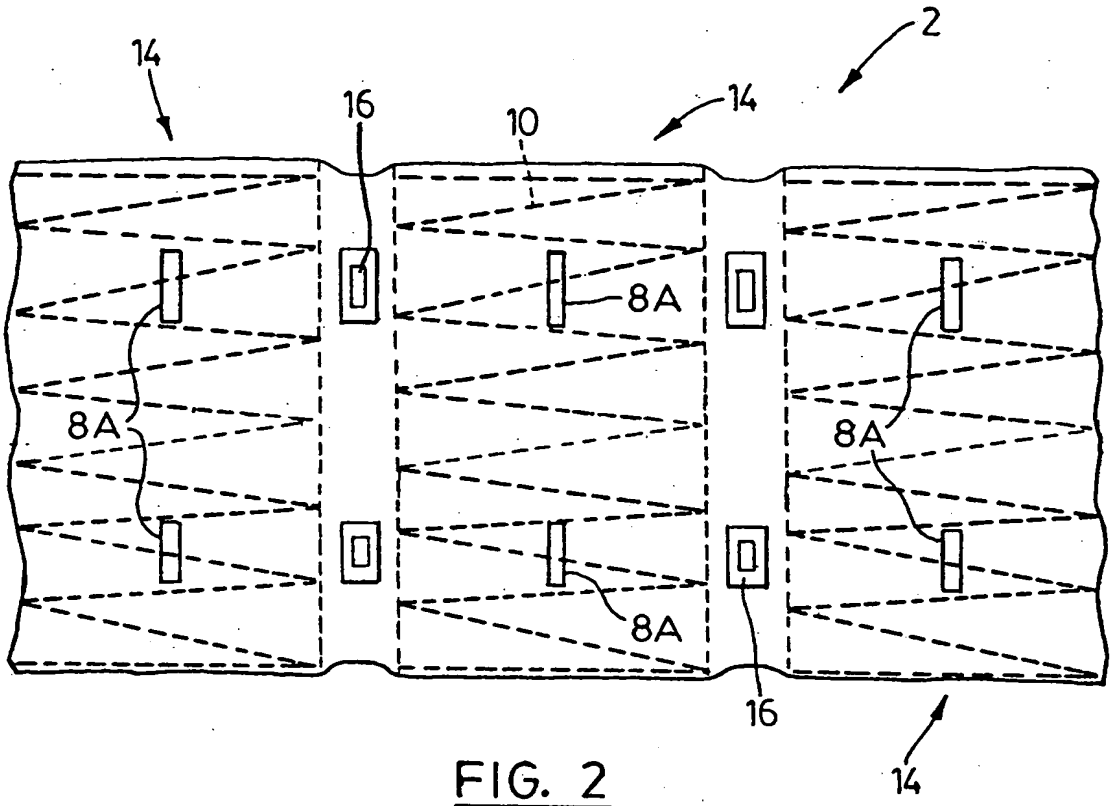


FIG. 2

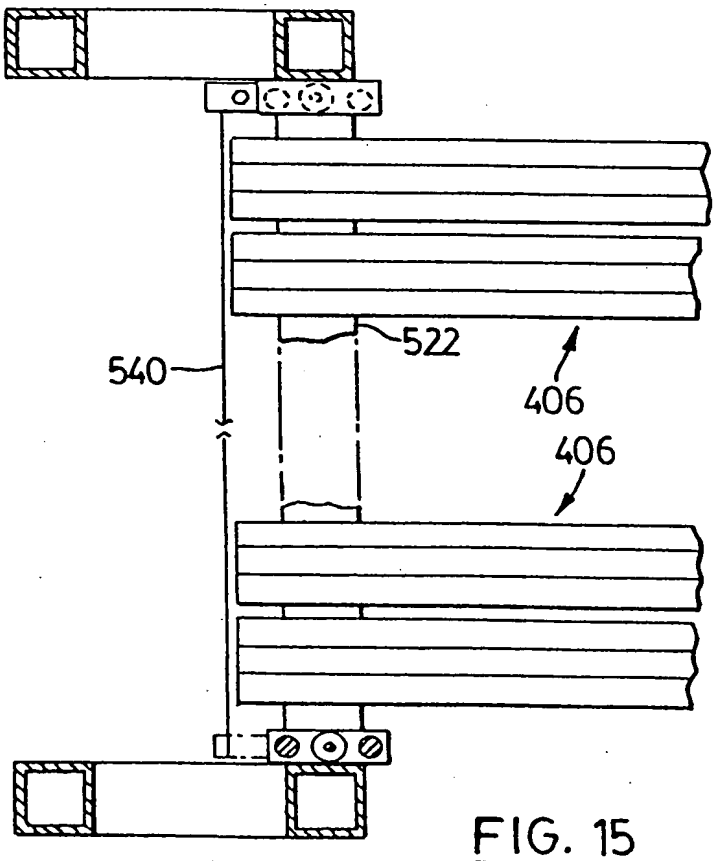


FIG. 15

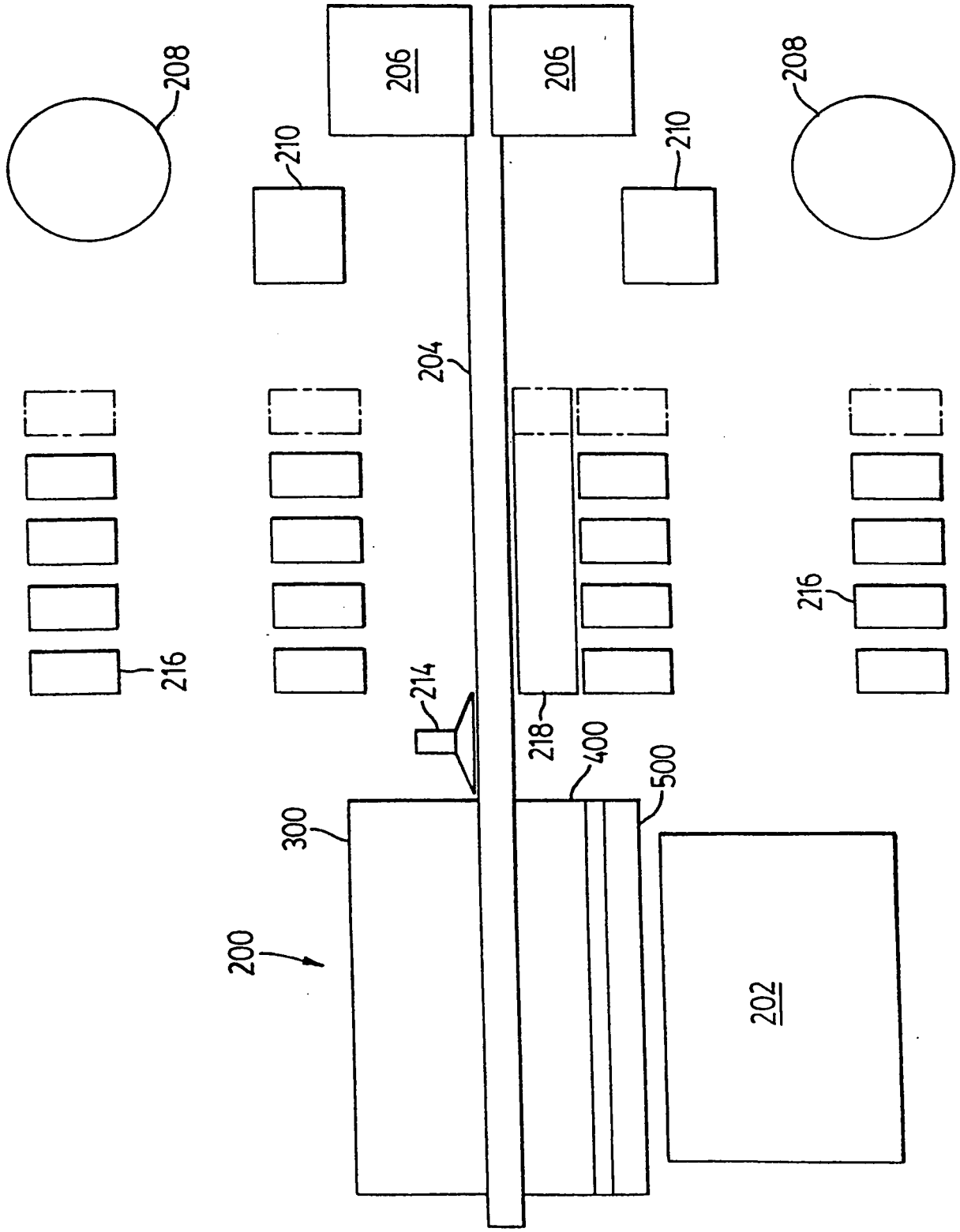


FIG. 3

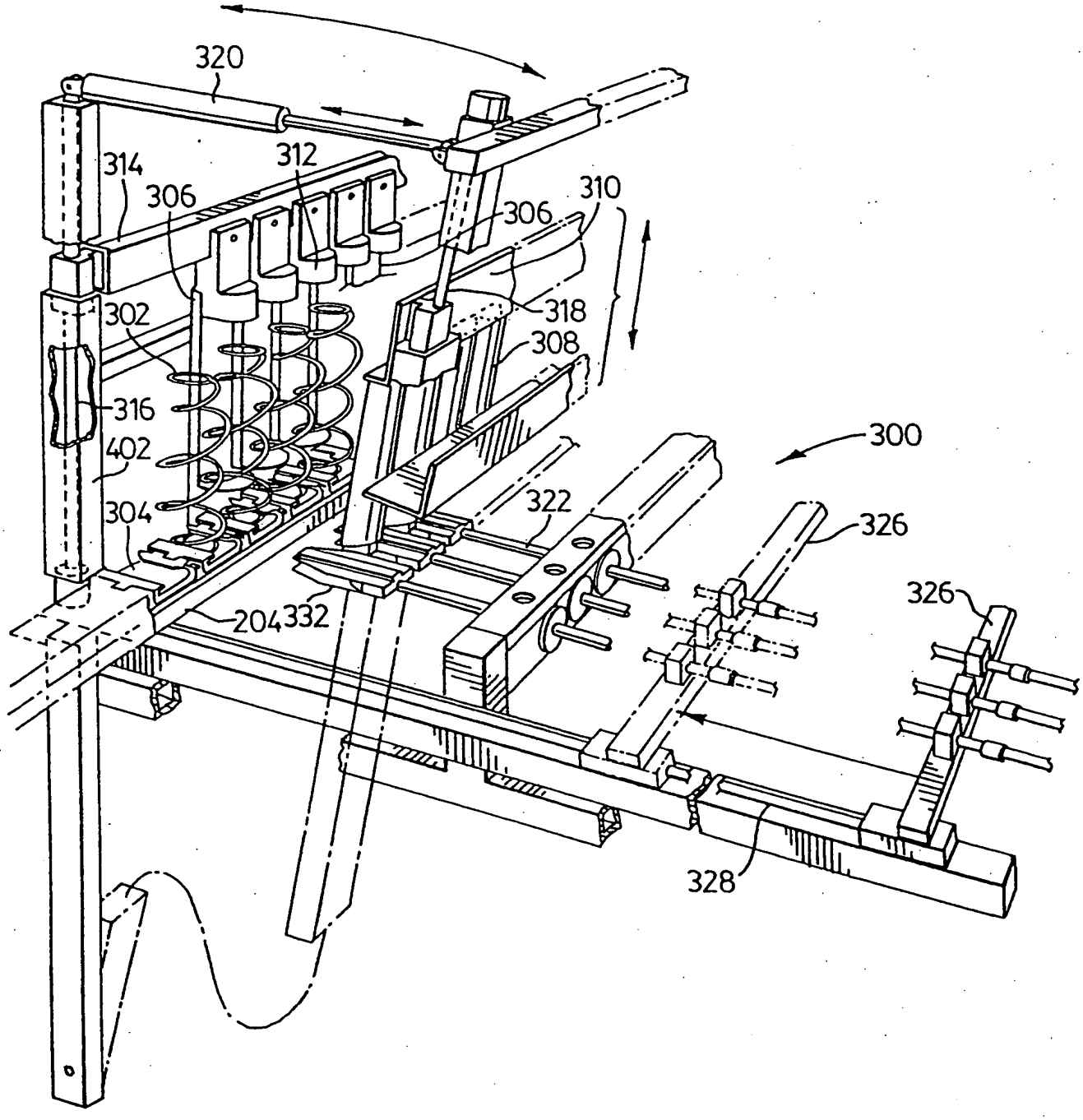

320
314
312
306
306
310
302
318
308
316
402
300
304
322
326
326
204
332
328

FIG. 4

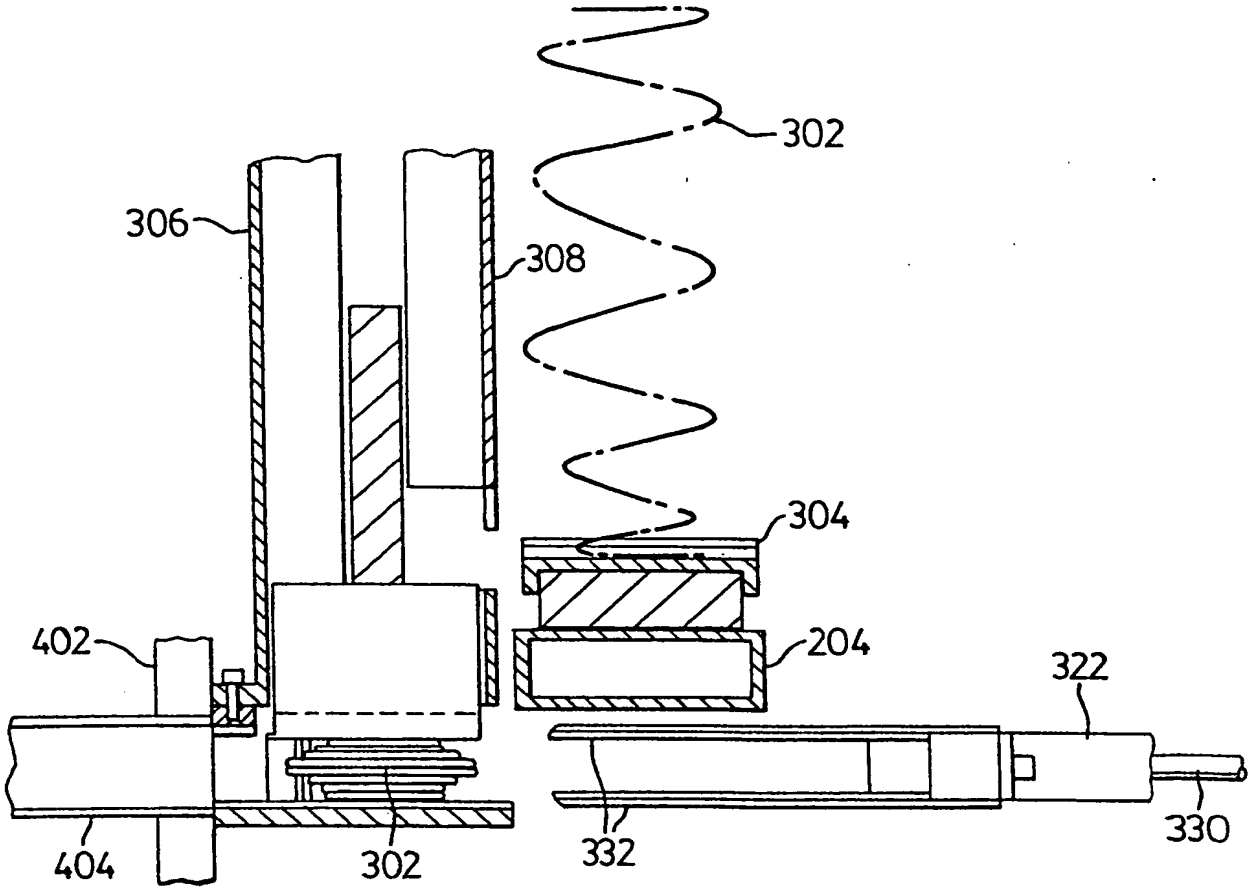

302
306
308
304
204
402
322
330
404
302
332

FIG. 4A

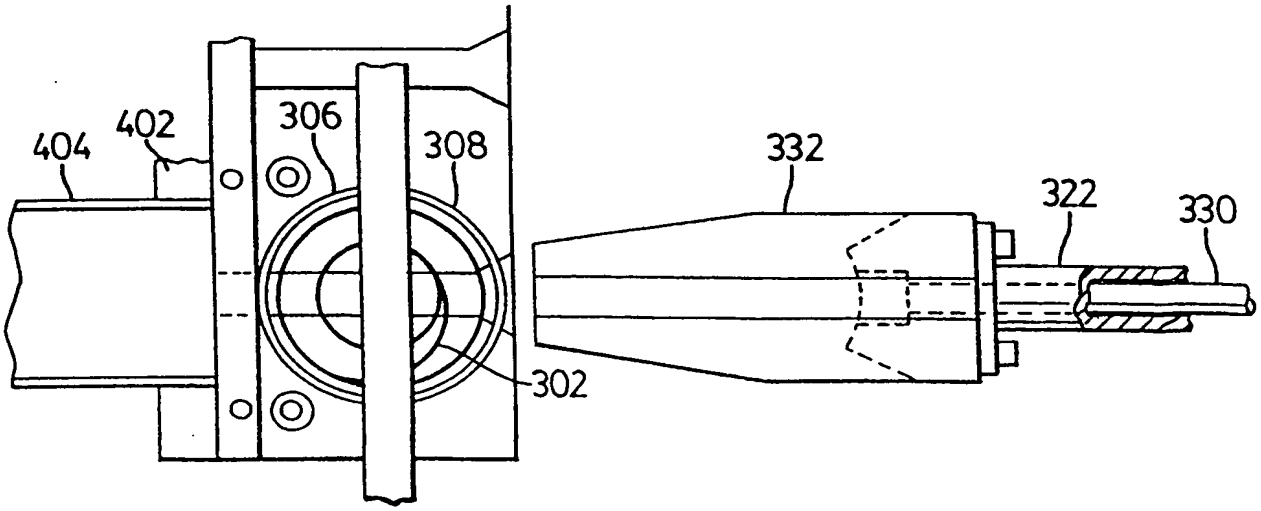

404
402
306
308
332
322
330
302

FIG. 4B

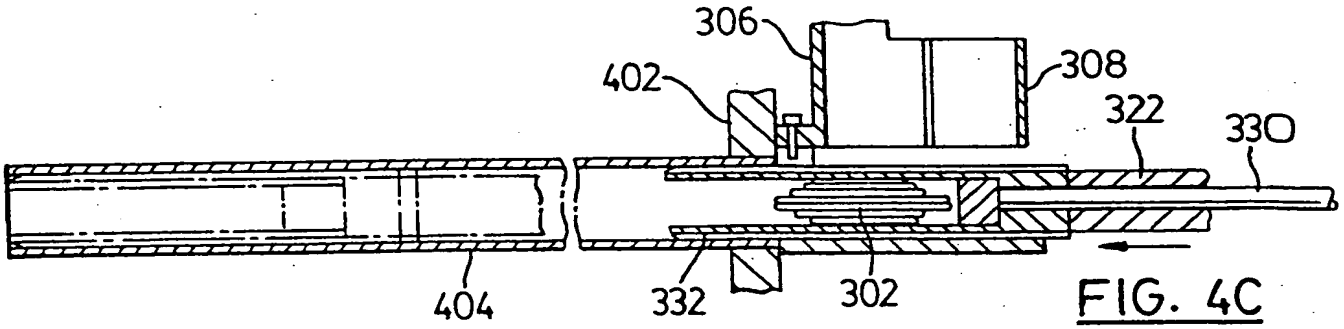


FIG. 4C

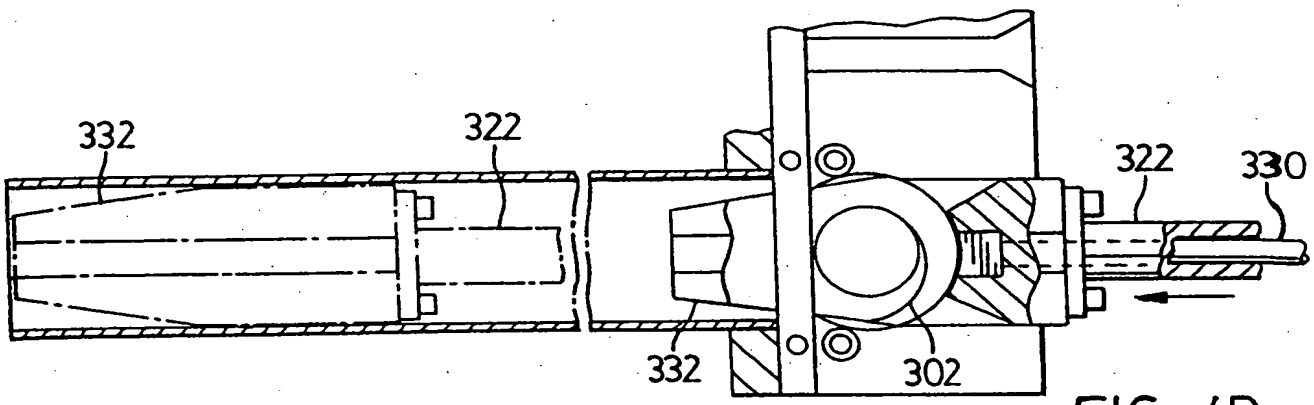


FIG. 4D

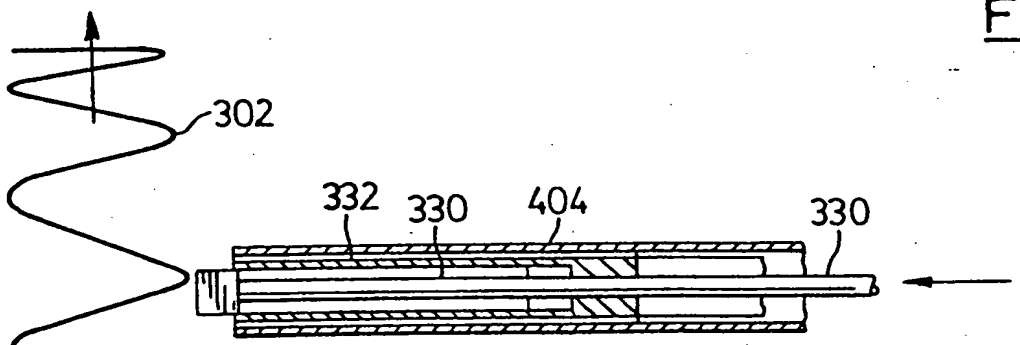


FIG. 4E

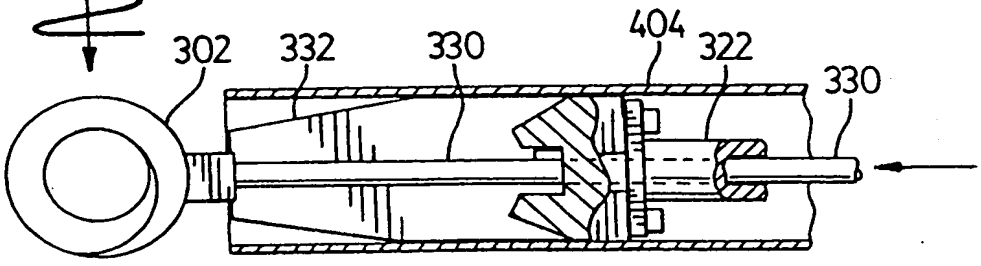


FIG. 4F

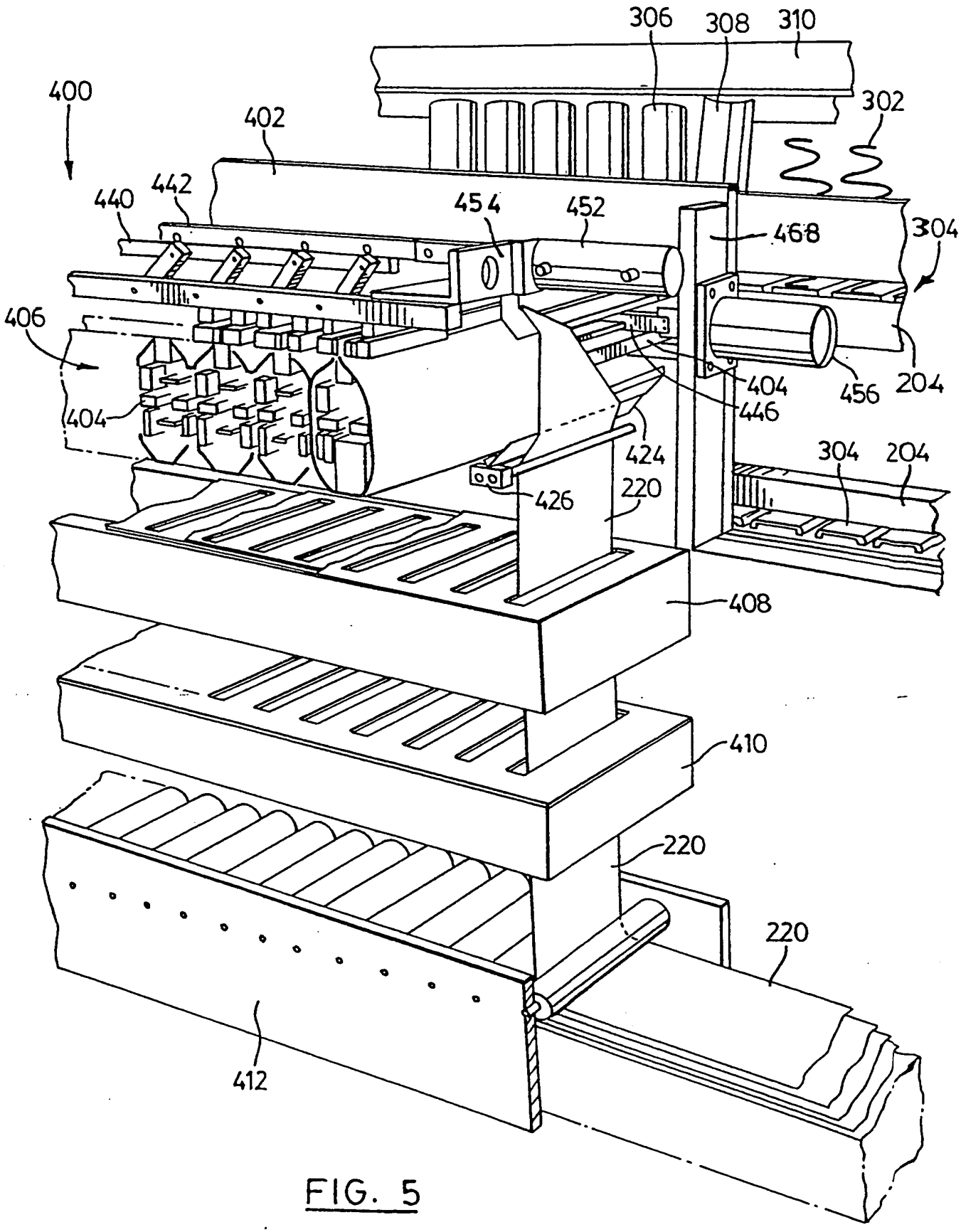

306
308
310
400
402
302
442
440
454
452
468
304
406
404
446
456
204
424
304
204
426
220
408
410
220
220
412

FIG. 5

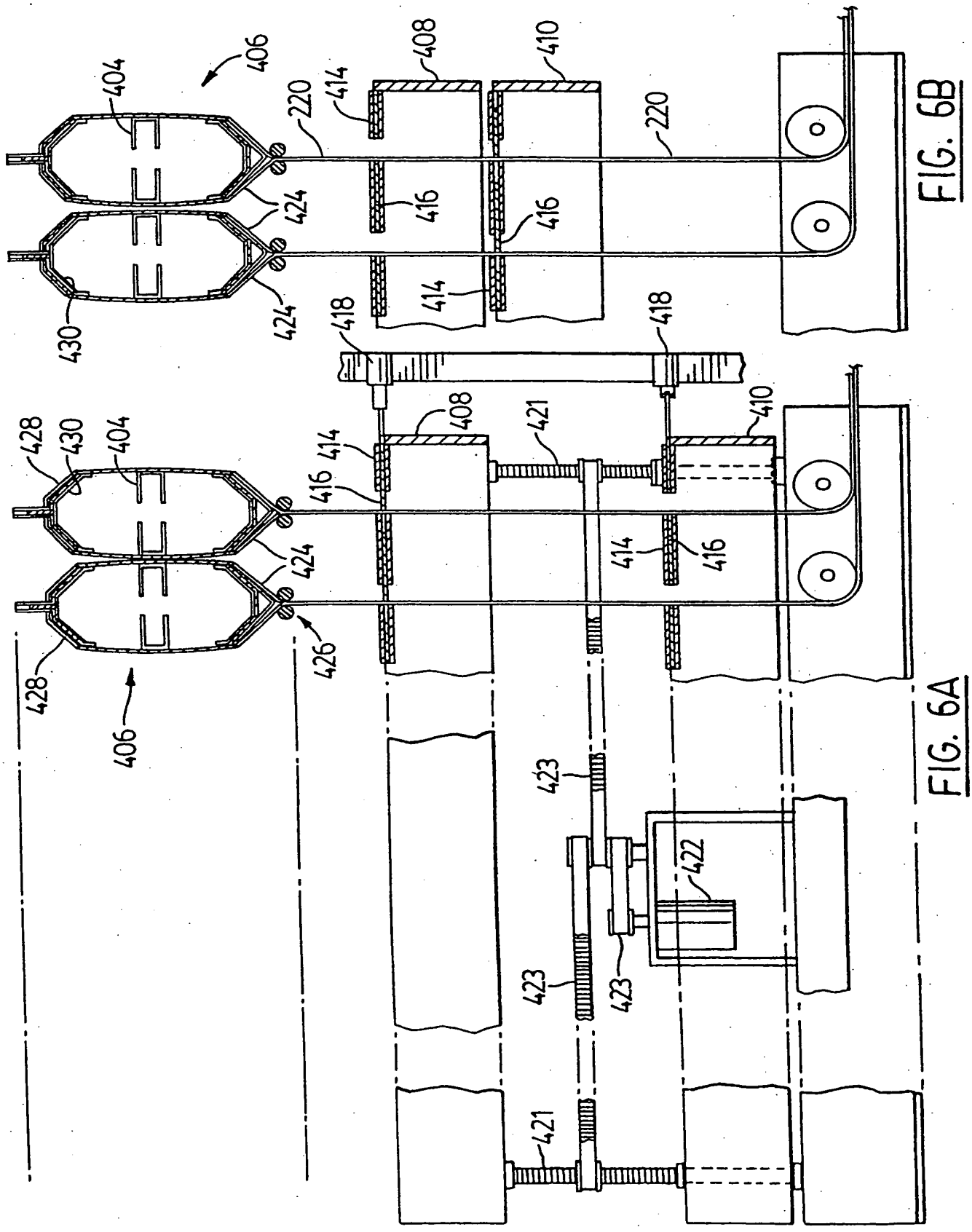


FIG. 6B

FIG. 6A

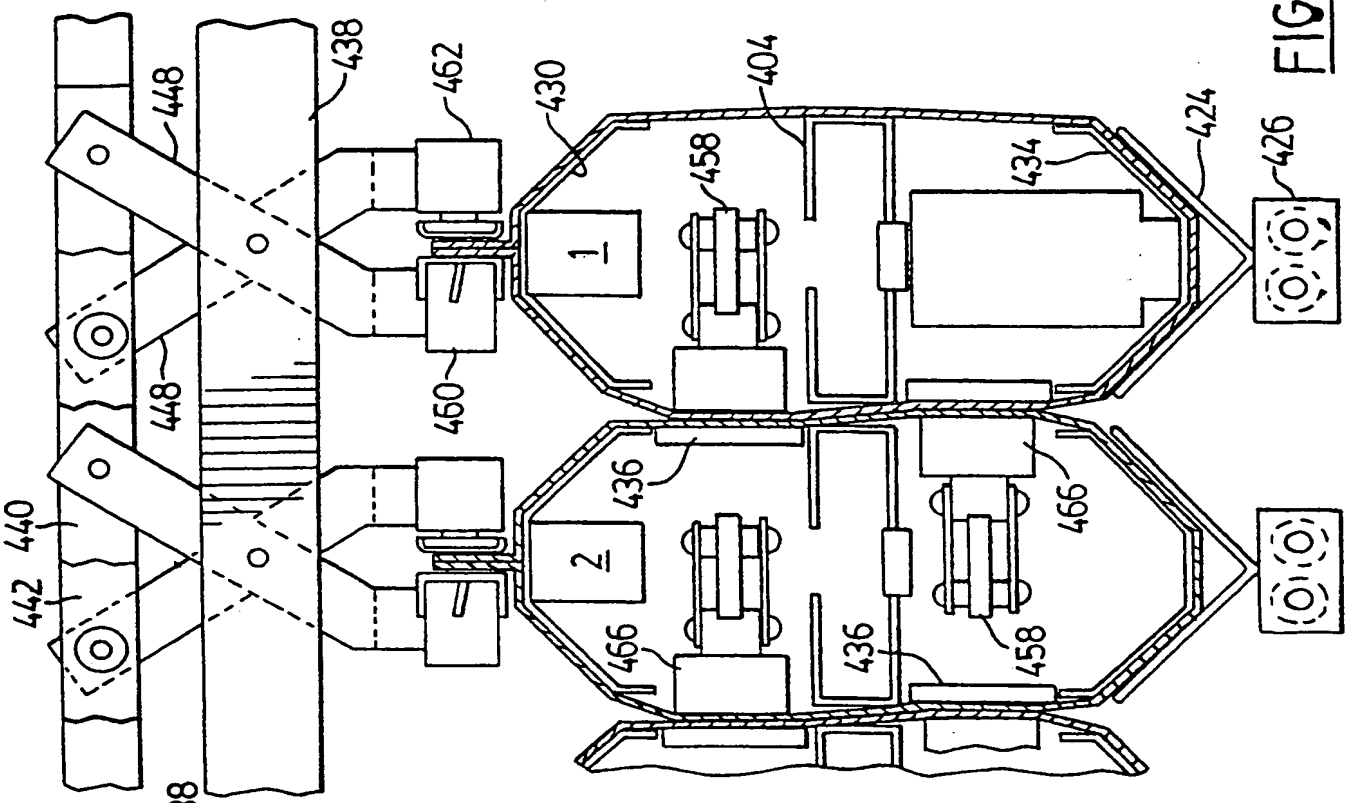


FIG. 7B

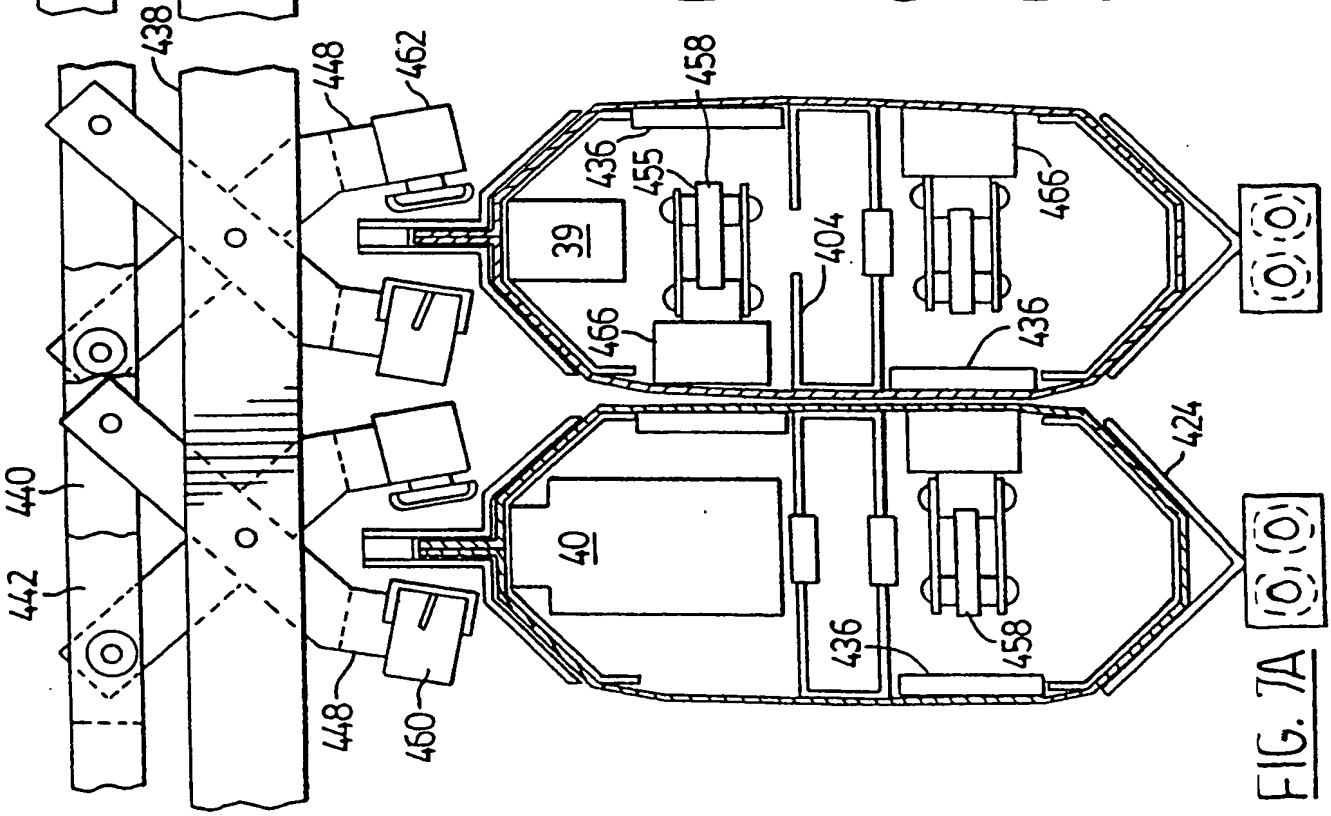


FIG. 7A

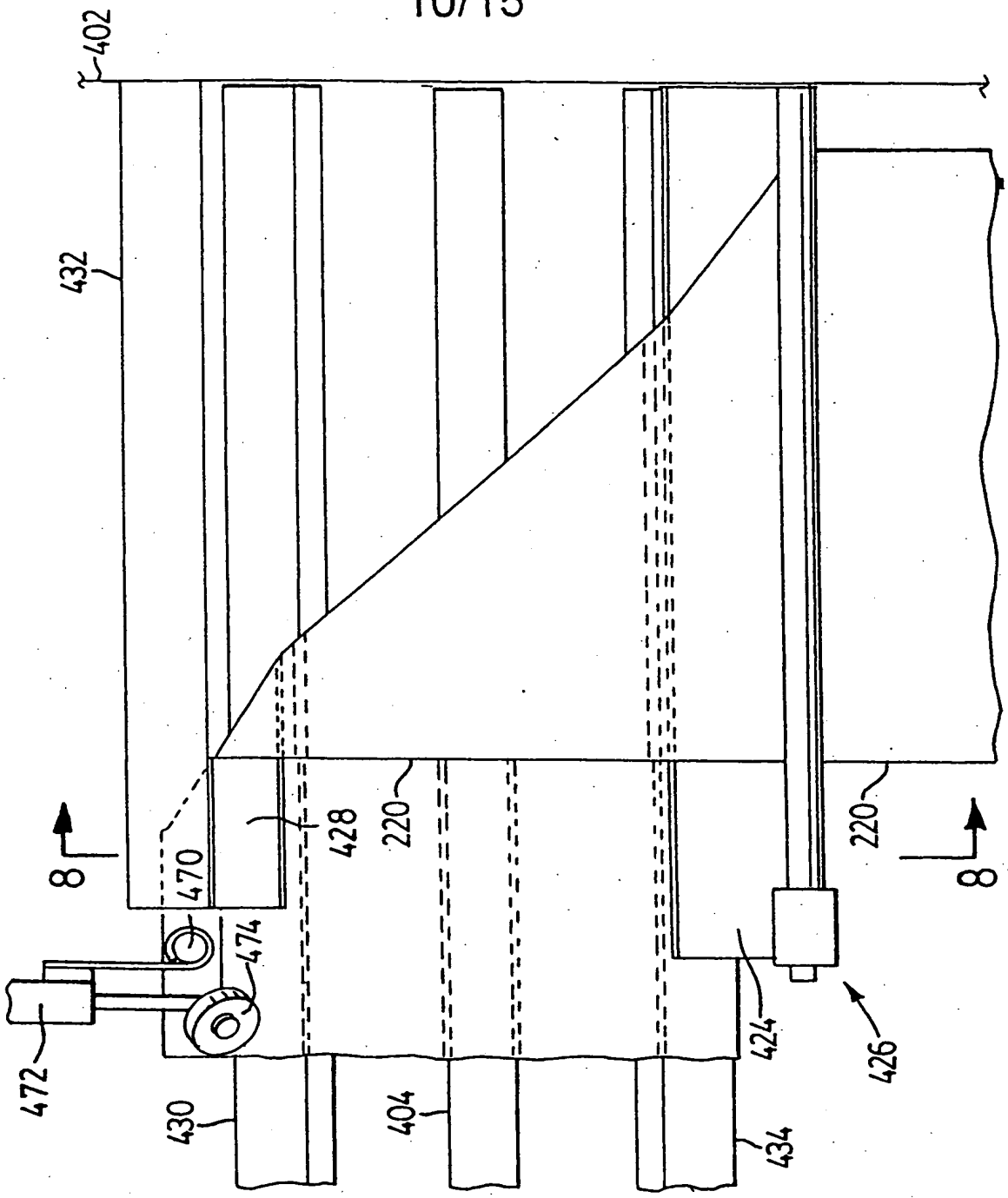

402
432
8
470
428
220
474
472
430
404
434
424
426
220
8

FIG. 9

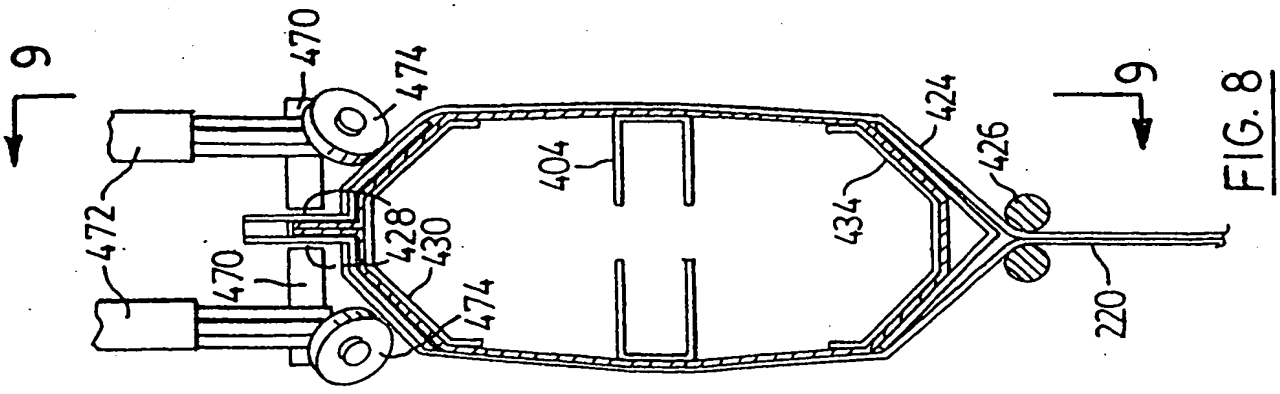

9
470
474
472
428
430
470
474
404
424
426
434
220
9

FIG. 8

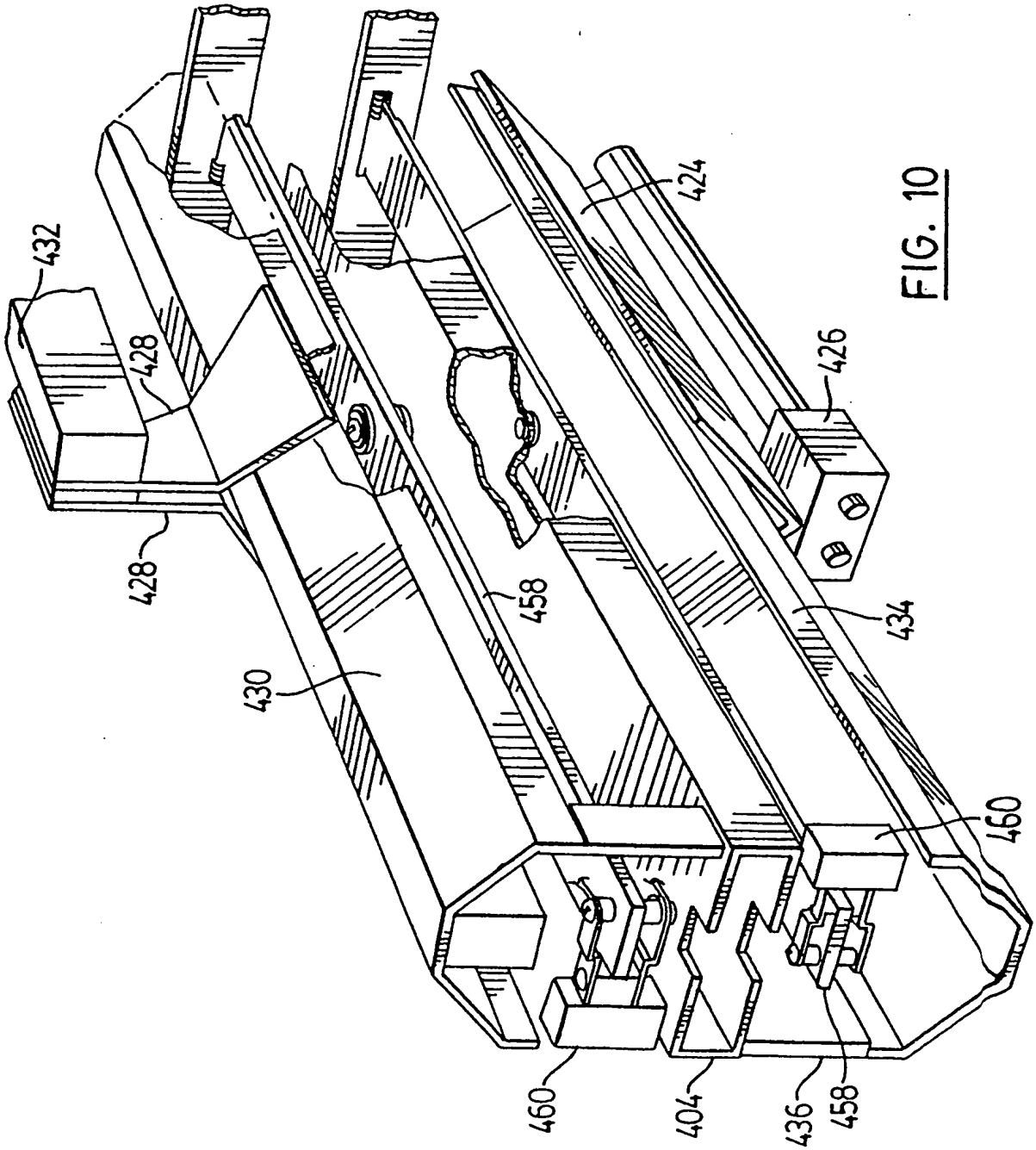


FIG. 10

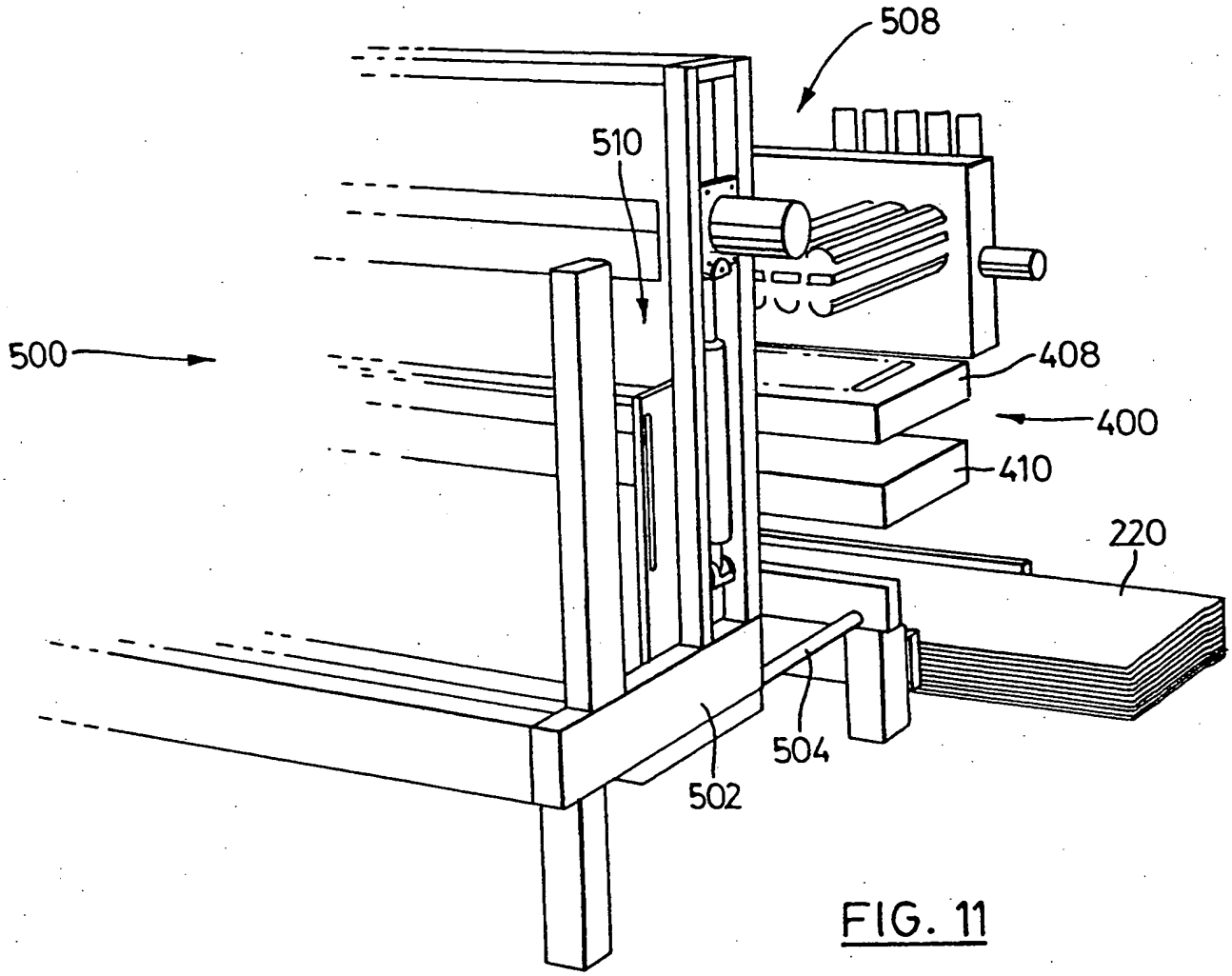


FIG. 11

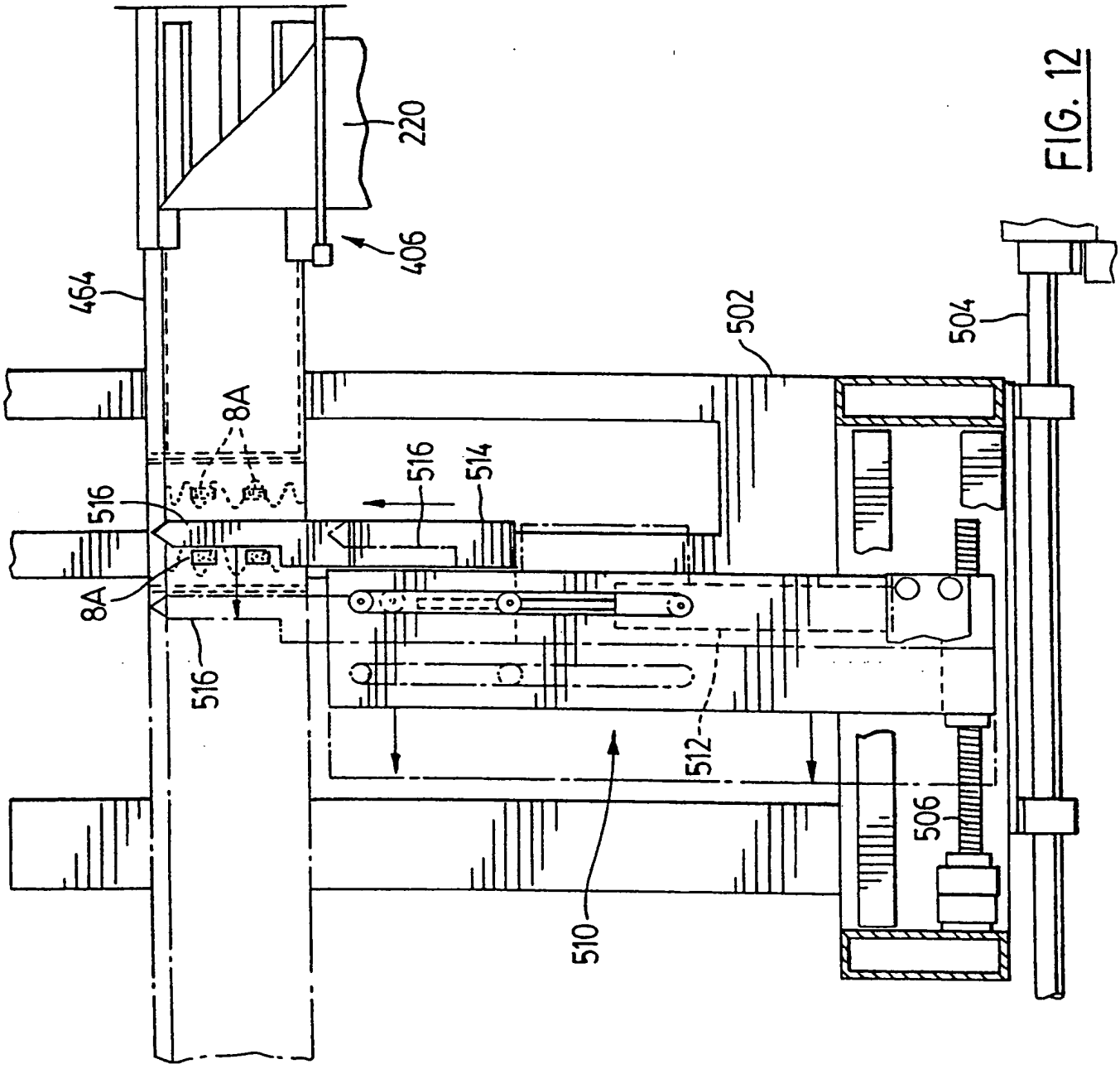


FIG. 12

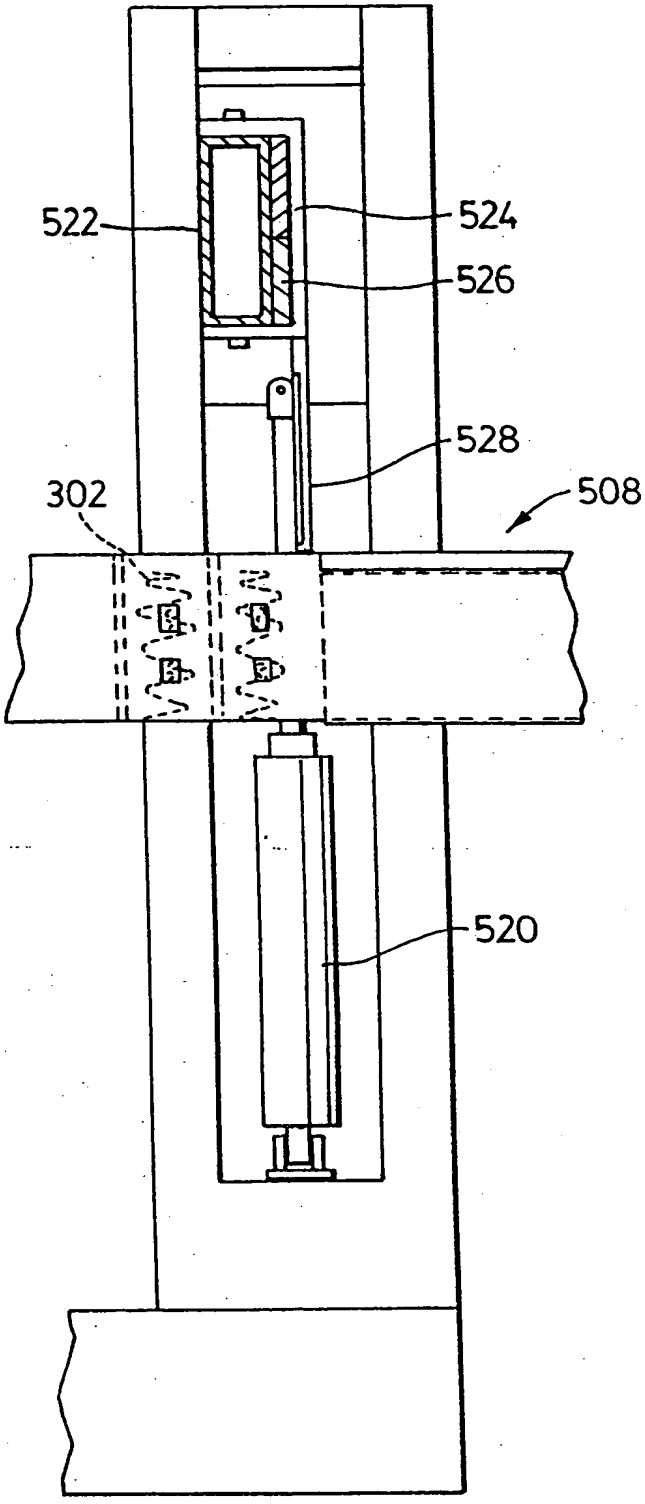


FIG. 13A

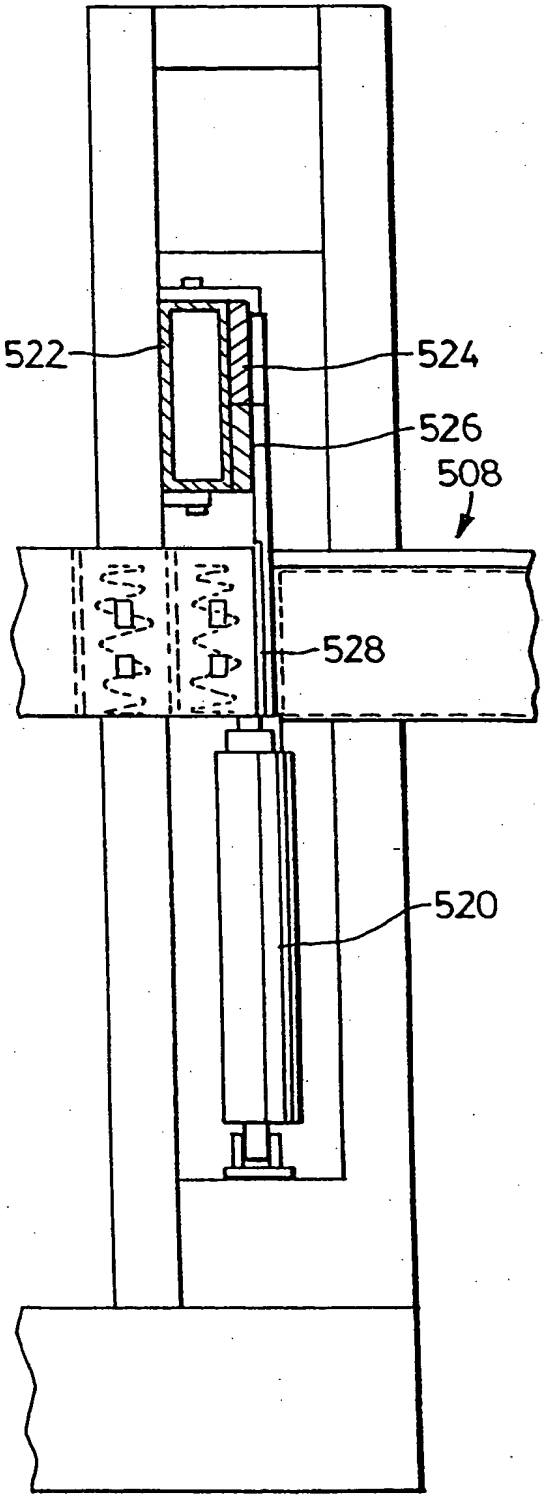


FIG. 13B

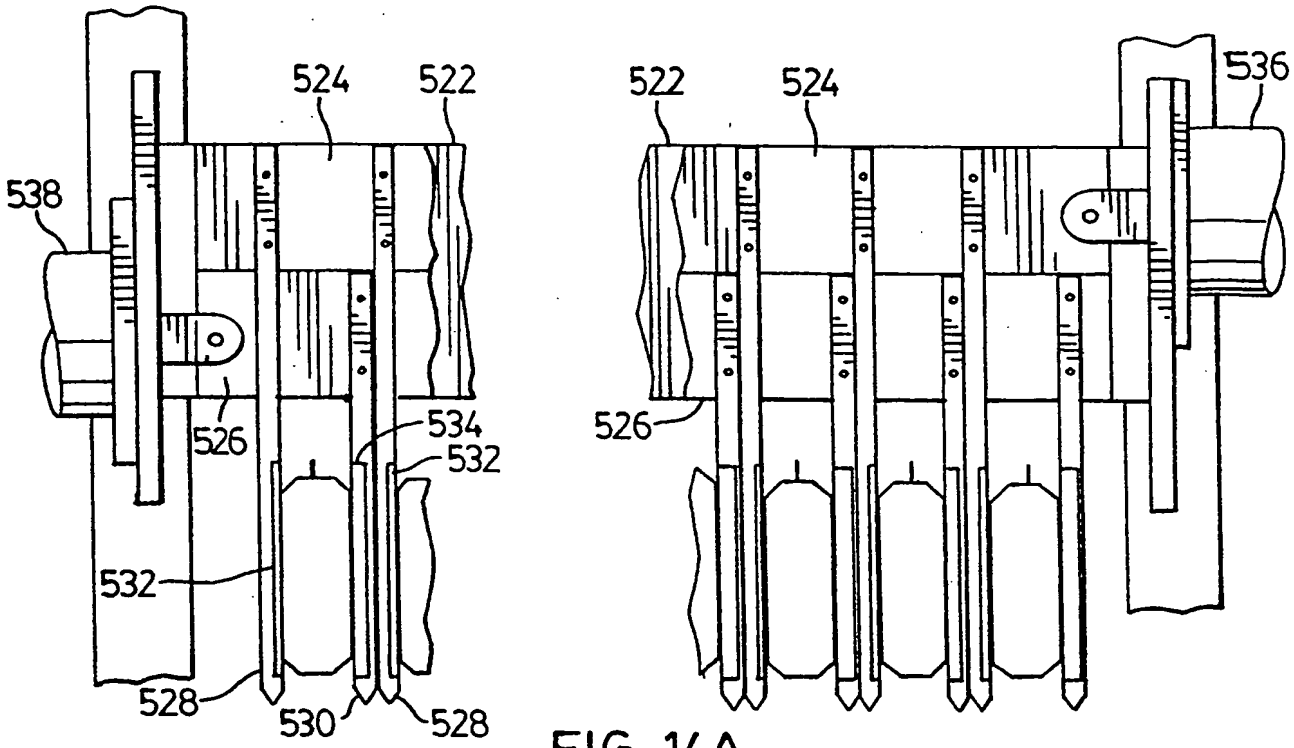


FIG. 14A

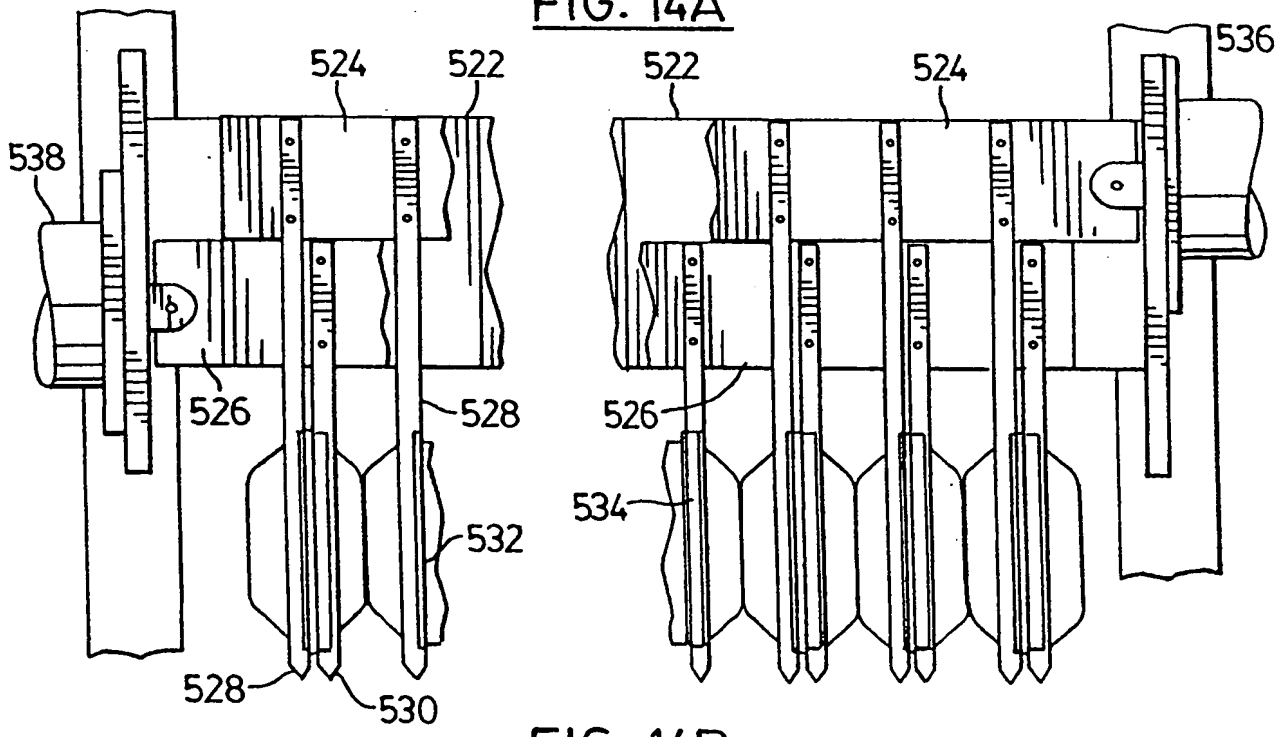


FIG. 14B